REMARKS

In further support of the claims presented, Applicant submits the following remarks.

I. Prosecution History and Current Status of Claims

Claims 1-33 were originally presented for examination. In the first Office Action: Claims 1-33 stand provisionally rejected under the judicially created doctrine of double patenting over claims in Application No. 10/026,016. Claim 1-33 also stand rejected under 35 U.S.C. § 112, second paragraph for being indefinite. Claims 1-33 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Eglash et al (5,251,255) in view Jewell et al. (6,359,920).

With his response to the first Office Action, Applicant has amended claims 1-2, 5-8, 15, 19, 21, 23-24, 27-33 as follows. Claims 1-33 continue to remain pending in the present application. Applicant believes his claim and specification amendments and the following remarks overcome the present rejections and he respectfully request reexamination of his application for patent.

II. Provisional rejection under "double patenting" doctrine.

Claims 1-33 stand provisionally rejected under the judicially created doctrine of double patenting over claims 1-34 of co-pending Application number 10/026,016. Applicant respectfully traverses the provisional rejection for the following reasons:

First, the present invention, as presented in independent claims 1, 24 and 28-33, claims a VCSEL with "*InGaAsN*" in its quantum well having a well depth of at least 40 meV. Application No. 10/026,016 independently claims "*InGaAsSbN*" in quantum wells that have a well depth of at least 40 meV. The Applicant will not include the distinguishing material elements identified above in quotes for the 10/026,019 application into that of '016 application or any another co-pending application. The titles for each case clearly set forth the distinctions between them, which are also based on the quoted material. These distinctions will be

maintained throughout prosecution of this and related cases until issuance of patents by the Applicant.

Second, all three applications cited by Examiner and the present application were filed by a common inventor, Dr. Ralph Johnson, for a common assignee, Honeywell International, on the same date, December 27, 2001. A double-patenting doctrine rejection seeks to prevent the extension of exclusivity sought by an applicant for an invention by filing subsequent applications covering the same subject matter. Applicant or his assignee cannot extend the term of protection available for its filings of the four associated applications being that each was filed on the same day and will expire twenty years from their filing under current U.S. Patent law.

The double-patenting doctrine also protects a licensee or the public where the lack of notice regarding common inventions may operate to the detriment of the licensee or public when subsequent "related" patents may issue. Applicant has amended the present application to provide notice via any patent that may issue that other related patent applications or patents for the present invention exist. The following notice, which will be entered on the first page of all related applications including the present application, should provide adequate notice:

> The present invention is related to the following co-pending patent applications: Serial No. 10/026,016 entitled "Vertical cavity surface emitting laser including indium, antinomy and nitrogen in the active region," filed December 20, 2001; Serial No. 10/026,020 entitled "Vertical cavity surface emitting laser including indium and antinomy in the active region," filed December 27, 2001; Serial No. 10/026,044 entitled "Indium free vertical cavity surface emitting laser," filed December 27, 2001; and Serial No. 10/026,055 entitled "Vertical cavity surface emitting laser including indium in the active region," filed December 27, 2001.

Applicant believes that his application does not pose a double-patenting issue given the different focus of his invention as provided in the independent claims as originally presented, and as now amended, when compared to the distinct claim scope for the co-pending applications, because of the common filing date and ownership of the applications, and because

the application has been amended to provide notice regarding the existence of associated applications/patents. For these reasons, Applicant respectfully request withdrawal of the provisional double patenting rejection.

III. Objections Under 35 U.S.C. § 112

Claims 1-33 stand rejected under 35 U.S.C. 112, second paragraph, as begin indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the inventions. Claims 1, 21, 24 and 28-33 were cited specifically for failing to provide any means, any structure and any structural relationship in order to support the VCSEL in the claims which render the claims confusing, vague and indefinite according the Examiner. Applicant respectfully traverses the rejection.

Applicant has amended Claims 1, 21, 24 and 28-33 in a manner that should further clarify the structural relationship between the elements (e.g., quantum well, barrier layers, and confinement layers) therein. A person skilled in the art of VCSELs understands the basic structure of semiconductor lasers. Applicants claims, when interpreted by those skilled in the art in light of Applicant's detailed specification, *Orthokinetics, Inc. V. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1576, 1 USPQ2d 1081, 1088 (Fed. Cir. 1986), sets forth the basic interrelationship between the quantum well, barrier layers and confining layers of a VCSEL device. Applicant's claims set forth the interrelationship of the quantum well, barrier layers and confining layers throughout the detailed specification and the claims apprise one of ordinary skill in the art of their intended scope. All the prior art of record cited by Examiner is also consistent in teaching a well-known and basic VCSEL structure that is generally used by Applicant is describing and claiming his invention. The interrelationship is clearly set forth in Applicant's claims as illustrated in italics and underline below:

> 1. A vertical cavity surface emitting laser (VCSEL), comprising:
>
> an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of InGaAsN and including barrier layers sandwiching said at least one quantum well; and

confinement layers sandwiching said active region.

21. A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of InGaAsN and including AlGaAs barrier layers sandwiching said at least one quantum well; and

confinement layers sandwiching said active region.

24. A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of InGaAsN and including barrier layers sandwiching said at least one quantum well; and

AlGaAs confinement layers sandwiching said active region.

27. The VCSEL of claim 24 wherein said at least one quantum well is up to and including 50Å in thickness.

28. A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of InGaAsN and including AlGaAs barrier layers sandwiching said at least one quantum well; and

AlGaAs confinement layers sandwiching said active region.

29. A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised ofe InGaAsN and including InGaAs barrier layers sandwiching said at least one quantum well; and

AlGaAs confinement layers sandwiching said active region.

30. A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of InGaAsN and including GaAsN barrier layers sandwiching said at least one quantum well; and

GaAsN confinement layers sandwiching said active region.

31. A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of InGaAsN and including AlGaAs barrier layers sandwiching said at least one quantum well; and

AlGaAs confinement layers sandwiching said active region.

32. A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of InGaAsN and including GaAsN barrier layers sandwiching said at least one quantum well; and

AlGaAs confinement layers sandwiching said active region.

33. A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of InGaAsN and including AlGaAs barrier layers sandwiching said at least one quantum well; and

GaAsN confinement layers sandwiching said active region.

The United States Patent and Trademark Office has recognized the ongoing concern presented by applicants regarding amendments to applications in light of *Festo Corp. v. Shoketsu Kinzolku Kogyo Kabushiki Co.*, 122 S.Ct. 1831, 62 USPQ2d 1705 (2002). The Office has clarified its policy with respect to rejections made under 35 U.S.C. § 112, second paragraph (effective immediately as of January 17, 2003, in a memorandum from Stephen G. Kunin, Deputy Comm. for Patent Examination Policy). According to current policy which will be published in the next revision of the MPEP (§ 2173.02), "during examination of claims for compliance with the requirements for definiteness under 35 U.S.C. §112, second paragraph, some latitude in the manner of expression and the aptness of terms should be permitted even though the claim language is not as precise as the examiner might desire." The memorandum goes on to say, "the examiner must consider the claim as a whole to determine whether the claim apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by 35 U.S.C. §112, second paragraph by providing clear warning to others as

to what constitutes infringement of the patent." (Citing *Solomon v. Kimberly-Clark Corp.*, 216 F.3d 1372, 1379, 55 USPQ2d 1279, 1283 (Fed. Cir. 2000).)

Applicant believes that he has done a good job of setting forth the structural elements and the interrelationship between elements in his claims as evidenced by Examiners use of similar language throughout the 35 U.S.C. § 103 discussion of the Office Action (see page 6, first paragraph, and page 8, paragraph 9, of the Office Action). Applicant's means of setting forth the structure and interrelationship of the quantum well(s), barrier layers, and confining layers is believed to be clear, simple and intuitive by the less than the skilled, falls within the scope of the Office's new guidance, and is well supported throughout the detailed specification.

For the foregoing reasons, Applicant respectfully traverses the rejection of his claims under 35 U.S.C. §112, paragraph 2, as being indefinite.

IV. Rejections under 35 U.S.C. § 103(A)

Claims 1-33 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Eglash et al (5,251,255) in view of Jewell et al. (6,359,920). With regards to independent claims 1, 21, 24 and 28-33, Examiner notes that Eglash et al does not teach quantum wells having depths of at least 40 meV. Examiner cites Jewell et al for support via a discussion in columns 6, 28 and illustration in their FIG. 2. The rejection of claims 1-33 is respectfully traversed.

Applicant respectfully points out to the Examiner before engaging in further discussion of the distinctions between his invention and the cited art that U.S. Patent 6,359,920 was issued on March 19, 2002, which defeats its use as a prior art reference as a basis for the current rejections; however, Applicant is and has become very familiar with the subject matter described by Jewell et al in the patent, as it is a divisional application of U.S. Patent Nos. 5,825,796 and 5,960,018, also issued to Jewell et al. Applicant acknowledges the general subject matter relied on by Examiner in citing the '920 to the extent it is provided in the '796 and '018 patents, which truly predate Applicant's filing of the present invention.

Jewell et al describes techniques and their effects on peak transition energy within VCSELs. The discussion at column 32 specifically identifies a range within which peak

transition energy can be changed, the range being from about 40 meV to 125 meV. Eglash et al similarly describes how a device can achieve power between an intense peak of 1.88 micrometers with full width at half maximum of 11 meV. The discussion in Jewell et al and Eglash et al are not directed to quantum well depths. Eglash et al is concerned with how much band gap efficiency or performance can be obtained using their device and techniques when referring to measurements in the quantity "meV." Jewell et al is focused on energy within the active region also. Neither Jewell nor Eglash teach quantum wells having depths of at least 40 meV.

By contrast to Eglash et al, Applicant is referring to achieving optimum band offset using quantum wells having depths of at least 40 meV. This "band offset" is clearly set forth in Claim 1 with respect to the quantum well element. Discussions of band offset achieved by quantum well depth and band gap efficiency are not interchangeable, as would be understood by those skilled in the art. When referring to a discussion of "band offset," one skilled in the art should realize that applicant is achieving optimum confinement of carriers within the quantum well(s) for his device where the quantum well(s) comprises well depth of at least 40 meV.

Claims 5 was also rejected, primarily under Jewell et al, because Jewell discloses the use of nitrogen within its quantum wells. Applicant notes that Jewell et al, has been cited for its use of nitrogen, noting specifically that Jewell's use of N is at a quantity of less than 1%. Examiner rejects claim 13 based on the use of <1% N by Jewell et al, stating that it has been held that discovering an optimum value of a result effect variable involves only routine skill in the art (citing *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980)). The rejection of claim 13 is respectfully traversed.

Applicant submits that it has been a long standing practice in the field to use less than 1% of nitrogen within the active region of a VCSEL because good luminescence has generally been hard to achieve where greater than 1% nitrogen is used. The use, however, of nitrogen at quantities approaching 1% has also shown longer wavelength production in VCSEL devices.

Applicant has overcome convention through the use of greater than 1% nitrogen in his devices, which has led to longer emission wavelengths. Use of greater than 1% nitrogen would not be an obvious practice to the skilled, as further proven by the Jewell et al reference specifically to use of less than 1%, because of the common practice of not exceeding more than 1% nitrogen to avoid device performance and failure concerns. For example, a difficulty that is experienced in the art where more than 1 % nitrogen is used in a device has been poor luminescence efficiency due primarily to the creation of non-radiative traps caused by increased (greater than 1%) nitrogen. Through his combination of materials and device architecture, Applicant has overcome device performance issue where greater than 1% nitrogen is used. Base on the foregoing distinction, the rejection of claim 5 for claiming use of greater than 1% nitrogen is also respectfully traversed.

Jewell et al does not teach a quantum well having a depth of at least 40 meV. Furthermore, Jewell et al does not teach the use of greater than 1% nitrogen within its devices. Therefore Applicant's Claims 1-34 are not obviated by the combination of Eglash et al and Jewell et al. For the foregoing reasons, the rejection of claims 1-33 is respectfully traversed.

V. Conclusion

Applicant has amended claims herein for the purpose of providing additional scope, clarity and some consolidation. The specification was amended to provide a notice of co-pending applications and to correct the citation to a U.S. patent (5,903,588) in the description. No new subject matter has been introduced as a result of this amendment. Attached hereto is a marked-up version of the changes made to the Specification and Claims by the current response, which is captioned "VERSIONS WITH MARKING TO SHOW CHANGES MADE."

In view of the foregoing discussion, Applicant has responded to each and every objection and rejection of the Official Action, and respectfully request that a timely Notice of Allowance be issued. Applicant respectfully submits that the foregoing amendment and

discussion does not present new issues for consideration and that no new search is necessitated. Accordingly, Applicant respectfully requests reconsideration of Claims 1-33.

Applicant believes he has demonstrated that his disclosed and claimed invention is novel and non-obvious relative to the prior art. Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned representative to conduct an interview before further written action in an effort to expedite prosecution in connection with the present application

Respectfully submitted,

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VERSIONS WITH MARKING TO SHOW CHANGES MADE

In re Application of	:	Ralph H. Johnson	: Docket No. V637-02674-US
Serial No.	:	10/026,019	: Art Unit No. 2828
Filing Date	:	12/27/2001	: Examiner. Tuan M. Nguyen

Invention Title : Vertical cavity surface emitting laser including indium and nitrogen in the active region

IN THE SPECIFICATION:

Please insert the following paragraph on 1 after the Title and the paragraph entitled "TECHNICAL FIELD":

-- **RELATED APPLICATIONS**

The present invention is related to the following co-pending patent applications: Serial No. 10/026,016 entitled "Vertical cavity surface emitting laser including indium, antinomy and nitrogen in the active region," filed December 20, 2001; Serial No. 10/026,020 entitled "Vertical cavity surface emitting laser including indium and antinomy in the active region," filed December 27, 2001; Serial No. 10/026,044 entitled "Indium free vertical cavity surface emitting laser," filed December 27, 2001; and Serial No. 10/026,055 entitled "Vertical cavity surface emitting laser including indium in the active region," filed December 27, 2001. --

On Page 16, replace the second full paragraph providing textual reference to Figure 12 with the following paragraph:

-- Referring to Figure 12, illustrated is a sectional view of a vertical cavity surface emitting laser **100** (VCSEL). The VCSEL **100** can be grown by techniques such as metal organic molecular beam epitaxy, or metal-organic chemical vapor deposition. Reference is made to U.S. Patent No. ~~5,903,589~~ 5,903,588, assigned to

the assignee for the present invention, which describes methods of VCSEL fabrication use in the art. The VCSEL can preferably be grown on a GaAs substrate **101** due to the robust nature and low cost of the material, however it should be recognized that semiconductor materials, Ge for example, could also be used as the substrate. The VCSEL **100** can then be formed by disposing layers on the substrate.
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IN THE CLAIMS:

Please amend the claims 1-2, 5-8, 15, 19, 21, 23-24, 27-33 where indicated below:

1. (*Once amended*) A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of InGaAsN~~;~~ and including barrier layers sandwiching said at least one quantum well; and

confinement layers sandwiching said ~~barrier layers~~active region.

2. (*Once amended*) The VCSEL of claim 1 wherein said barrier layers are comprised of GaAsN~~barrier layers~~.

5. (*Once amended*) The VCSEL of claim 1 wherein said at least one quantum well further comprises >1% N ~~added to the quantum well(s)~~.

6. (*Once amended*) The VCSEL of claim 1 wherein said at least one quantum well is up to and including 50Å in thickness.

7. (*Once amended*) The VCSEL of claim 5 wherein said at least one quantum well is up to and including 50Å in thickness.

8. (*Once amended*) The VCSEL of claim 1 wherein said barrier layers are comprised of GaAsN~~barrier layers~~.

15. (*Once amended*) The VCSEL of claim 14 wherein said barrier layers are comprised of GaAsN~~barrier layers~~.

19. (*Once amended*) The VCSEL of claim 1 wherein said at least one quantum well further comprises >1% N ~~added to the quantum well(s)~~.

21. (*Once amended*) A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of InGaAsN~~;~~ and including AlGaAs barrier layers sandwiching said at least one quantum well; and

confinement layers sandwiching said ~~barrier layers~~active region.

23. (*Once amended*) The VCSEL of claim 21 wherein said at least one quantum well is up to and including 50Å in thickness.

24. (*Once amended*) A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of InGaAsN~~;~~ and including barrier layers sandwiching said at least one quantum well; and

AlGaAs confinement layers sandwiching said ~~barrier layers~~active region.

27. (*Once amended*) The VCSEL of claim 24 wherein said at least one quantum well is up to and including 50Å in thickness.

28. (*Once amended*) A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of~~comprising~~ InGaAsN~~;~~ and including AlGaAs barrier layers sandwiching said at least one quantum well; and

AlGaAs confinement layers sandwiching said ~~barrier layers~~active region.

29. (*Once amended*) A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of~~comprising~~ InGaAsN~~;~~ and including InGaAs barrier layers sandwiching said at least one quantum well; and

AlGaAs confinement layers sandwiching said ~~barrier layers~~active region.

30. (*Once amended*) A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of~~comprising~~ InGaAsN~~;~~ and including GaAsN barrier layers sandwiching said at least one quantum well; and

GaAsN confinement layers sandwiching said ~~barrier layers~~active region.

31. (*Once amended*) A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of~~comprising~~ InGaAsN~~;~~ and including AlGaAs barrier layers sandwiching said at least one quantum well; and

AlGaAs confinement layers sandwiching said ~~barrier layers~~active region.

32. (*Once amended*) A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of~~comprising~~ InGaAsN; and including GaAsN barrier layers sandwiching said at least one quantum well; and

AlGaAs confinement layers sandwiching said ~~barrier layers~~active region.

33. (*Once amended*) A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of~~comprising~~ InGaAsN; and including AlGaAs barrier layers sandwiching said at least one quantum well; and

GaAsN confinement layers sandwiching said ~~barrier layers~~active region.